CHAPTER 2 STUDY METHODS

2.1 INTRODUCTION

This chapter describes the methodologies and associated assumptions that were used to conduct this siting study for the Townsend to Midpoint 500kV Transmission Line Project (Project). The methods used for this siting study included collection and review of existing data, largely from various Montana and Idaho field offices of the Bureau of Land Management (BLM), individual National Forests of the USDA Forest Service, and from State of Montana and Idaho resource, transportation and land management agencies (also refer to Appendix A-3 for a list of agencies and persons contacted).

Data was collected pertaining to land use, visual resources, cultural resources, biological resources, water resources and earth resources. Data collection was followed by sensitivity analysis and mapping using criteria established by the planning team. Available GIS coverages with associated metadata were assembled and reviewed, relevant data was selected and mapped, and sensitive areas that would influence the location of feasible corridors were identified.

The study approach included twelve major tasks:

- Base Map Refinement
- Study Area Definition
- Data Collection and Mapping
- Sensitivity Criteria and Analysis
- Opportunities and Constraints Evaluation
- Corridor and Substation Sites Identification
- Ground Reconnaissance of Corridors
- Alternative Route and Substation Site Identification
- Preliminary and Residual Impact Assessment
- Alternative Route and Substation Comparison
- Preferred Route and Substation Selection
- Identification of Permitting Requirements

2.2 BASE MAP

A project base map was prepared at a scale of 1:400,000 (1 inch = 6.31 miles). The 1:400,000 scale base map is a single sheet and was used to initially display resource data for the entire project area. Data categories and factors that were determined to be appropriate for sensitivity analysis were selected and mapped at a scale of 1:400,000 for interpretation, inventory and analysis.

Data displayed on the 1:400,000 scale map included: major federal and state land jurisdiction and private ownership, major roads and highways, transmission lines, wilderness and wilderness study areas, major political subdivision boundaries as well as lakes, reservoirs, rivers and ponds overlayed on a topographic hill-shade. This map scale was used to display various resource sensitivities, composite constraints and

opportunities and the alternative corridors. An additional sheet at 1:12,000 scale was developed for the substation analysis and siting process.

2.3 STUDY AREA

The Project study area was defined to include feasible alternatives for the location of a 500kV transmission line, or alternatively a 230kV or 345kV line. Major physiographic features, jurisdictional boundaries, sensitive land uses and existing utility corridors helped to define the study area boundaries, representing the limits of reasonable or feasible transmission line alternatives for the Project. The extent of the study area is described below and illustrated in Exhibit 1. The size of the study area is approximately 25,000 square miles.

The northern portion of the study area boundary is in Montana, and the northern boundary of the study area is defined by the location of the existing Colstrip 500kV transmission lines, and by the alternative northern terminations at either the existing Garrison Substation, a new Townsend substation site, or a new Ringling Substation.

The eastern boundaries were defined east of Bozeman and the Bridger Range, and by the designated Wilderness areas on the west side of Yellowstone National Park. The Madison River valley on the west side of the Madison Range is the boundary outside of which we considered that no reasonable alternative routes could be located. From Henry's Lake south, the study boundary follows Henry's Fork and then the main Snake River.

In Idaho, the southern, western and eastern boundaries were defined to include logical boundaries, including the existing transmission line corridor between Borah, Brady and Midpoint Substations. The boundaries also avoided the Fort Hall Indian Reservation and the urban areas of Idaho Falls, Pocatello, and Twin Falls.

The western boundary is defined almost solely on difficult mountains and terrain in the Bitterroot and Lemhi Ranges on or near the Montana – Idaho border. Most of the mountain ranges within the study area are north-south trending, and would be very difficult to cross from east to west. The White Knob and Pioneer Mountains both present terrain challenges that similarly helped identify the boundary in the southern portion of the study area to the west of the Idaho National Laboratory (INL).

2.4 DATA COLLECTION

Resource data covering the two study areas were obtained from a variety of sources. Sources included published and unpublished literature, documents, reports, studies, maps, BLM Resource Management Plans (RMPs) and Forest Service Plans. Available GIS coverages were obtained from BLM, Forest Service and other federal agencies such as the US Department of Agriculture, National Resources Conservation Service (NRCS) and Montana and Idaho state agencies and other national and state data bases.

Meetings with Montana and Idaho state office personnel, BLM field offices and Forest Service resource specialists in the seven National Forests were conducted to gather pertinent data and information, and to seek agency guidance on avoidance areas and areas of agency preference for the siting of a new transmission line corridor. Inventory data were collected for six primary resource areas including land use resources, visual resources, cultural resources, biological resources, water resources and wetlands and earth resources and slope. Resource data were then mapped utilizing GIS.

Once inventory mapping was completed, the maps were subsequently utilized for the purposes of conducting sensitivity analysis, identifying opportunities and constraints and identifying feasible alternative corridors. The following provides information on the inventory methodologies by resource area.

2.4.1 Land Use

The two areas of study (Idaho & Montana) are comprised of numerous jurisdictions and land uses. Land use data was collected from a variety of federal, state, and local sources and is generally organized into the following five categories:

- Land Jurisdiction
- Existing Land Use
- Linear Facilities
- Planned Land Use
- Parks, Recreation, and Preservation Areas

Available secondary data was mapped to identify existing conditions as well as to determine the potential sensitivity to the development of a 500kV transmission line. Data gathered from various sources included existing maps, land use plans, Geographic Information System (GIS) data layers, aerial photographs, limited site reconnaissance, and various contacts with federal, state, and county agency representatives. Inventory and sensitivity maps were developed at a scale of 1:400,000.

Land Jurisdiction

Land jurisdiction is defined as the jurisdictional control maintained by major landholders or land managers. Jurisdiction does not necessarily represent ownership. Established outside boundaries are depicted in lieu of more detailed in-holdings, lease agreements, joint ownership, etc.

It is important in this type of study to identify jurisdictional boundaries, since conflicts can result merely from crossing them. For example, a 500kV transmission line across publicly held land may cause a conflict with ongoing planning processes or a land management plan. Further, an incorporated area may be politically sensitive to a transmission line right-of-way.

Land jurisdictions were identified and delineated primarily from agency land status maps and GIS coverages.

Existing Land Use

Existing land uses inventoried include urban/developed, agriculture, military, and air facilities (Exhibit 2). The primary sources of information were aerial photography and agency GIS databases.

Urban/Developed – The urban/developed classification represents concentrations of surface disturbing land uses, which include residential, institutional, commercial, and/or industrial land uses. Urban areas were identified by municipal boundaries and parcel densities identified within Public Land Survey System (PLSS) sections.

Agriculture – The agriculture classification represents a combination of irrigated and non-irrigated field crops, as well as pasture.

The agricultural land within the study area was interpreted and delineated from aerial photography and the use of agency GIS databases.

Military – The military classification category includes military withdrawals, military operating areas (MOAs), and military training routes (MTRs).

- *MOAs* are defined as airspace designated for non-hazardous military activity such as acrobatics, air combat tactics and formation training. The designation informs and segregates non-participating instrument flight rules aircraft from the activity. Visual flight rules aircraft are not restricted from operating in military operations areas.

- *MTRs* are designated for military flight training at airspeeds in excess of 250 knots. There are two types of military training routes:

    - *Instrument Flight Rules* - for low-altitude navigation and tactical training below 10,000 feet and at airspeeds in excess of 250 knots at night and in foul weather.

    - *Visual Flight Rules* - for low-altitude navigation and tactical training below 10,000 feet at airspeeds in excess of 250 knots under visual flight rules.

Military classifications were derived from agency databases and U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office Sectional Aeronautical charts at a scale of 1:500,000.

Air Facilities – The inventory of air facilities included public and private airports registered with the Federal Aviation Administration. U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office Sectional Aeronautical charts, at a scale of 1:500,000 were also reviewed.

Linear Facilities

The linear facilities inventory included two categories of linear corridors: (1) existing electrical high voltage transmission lines, railroads, major paved roads and highways; and (2) agency designated or proposed utility/energy corridors (Exhibit 2). Paralleling or utilizing existing linear facility rights-of-way is considered to be an opportunity in selecting alternative corridors for new transmission lines. In general, locating a transmission line in these areas tends to result in less environmental impacts because of existing disturbances, access and unnatural linear features.

Existing or secondary data sources include utility company and regional system maps, federal agency plans and environmental impact statements (EISs), USGS 1:250,000 maps, and other planning documents. The level of detail and geographic accuracy of these data varied significantly, primarily due to the number of managing agencies, mapping accuracy, and scale.

The process of utility corridor planning has been left to individual agencies or administrative units, resulting in a set of policies toward utility corridor planning and implementation. However, this process is not always coordinated at the state or regional level. For example, adjacent BLM field offices and national forests may identify specific corridors, which do not connect at their common boundaries. Some agencies identify specific widths for corridors, while others designate windows of opportunity varying in size where no land conflicts are apparent. Some agencies specify that designated corridors generally parallel existing transmission lines, pipelines, or roads, often without reference to corridor width or limits to the number or type of facilities allowed for each corridor.

Section 368 of the Energy Policy Act of 2005 (the Act), Public Law 109-58 (H.R. 6), enacted August 8, 2005, directed the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior (the Agencies) to designate under their respective authorities corridors on Federal land in the 11 Western States (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) for oil, gas and hydrogen pipelines and electricity transmission and distribution facilities (energy corridors). An energy corridor is defined as a parcel of land either linear or areal in character that has been identified through the land use planning process as being a preferred location for existing and future right-of-ways and suitable to accommodate one or more rights-of-way which are similar, identical or compatible.

As such, the Agencies are preparing a programmatic environmental impact statement (PEIS) entitled, "West-Wide Energy Corridor Programmatic Environmental Impact Statement" to address the environmental impacts from the proposed action and the range of reasonable alternatives. DOE and BLM are the co-lead agencies for this effort, with the U.S. Department of Agriculture's Forest Service (USFS) participating as a cooperating agency. Based upon the information and analyses developed in this PEIS, each Agency would amend its respective land use plans by designating a series of energy corridors.

For the purposes of this study, individual agencies' designated or proposed corridors have been mapped where the corridor locations have been identified in a manner suitable for use in the transmission line siting process.

Planned Land Use

The planned land use component identifies objectives and/or policies regarding the locations of major transmission lines per agency adopted or approved land use plans.

The BLM prepares comprehensive land use plans to guide management decisions and actions on public lands. Before 1985, BLM's land use plans were called Management Framework Plans (MFPs). Since 1985, BLM's land use plans are called Resource Management Plans (RMPs). RMPs are prepared for relatively large areas of public lands, called planning areas that tend to have similar resource characteristics. These planning areas usually coincide with BLM's field office boundaries. RMPs are also prepared for BLM-managed National Monuments and National Conservation Areas, which are components of the National Landscape Conservation System.

Forest Service Plans provide strategic direction by goals and objectives for management of a National Forest developed through agency and public involvement.

Parks, Recreation, and Preservation Areas

This category primarily includes existing areas that are:

- dedicated as park land or open space by a governmental agency
- recognized as nationally or regionally significant preservation or recreation area
- formally designated unique or undisturbed natural areas

Parks, preservation, and recreation areas were identified through agency documents and GIS databases.

2.4.2 Visual Resources

Introduction

Visual resources in the project area were identified from two major existing sources: agency management objectives and scenic corridors in the form of designated scenic and historic trails and scenic highways (Exhibit 4).

Visual management objectives utilized by both the USFS and BLM were considered for project corridor siting. These objectives typically define the degree of acceptable change (visual contrast) permitted within each classification. A greater restriction is placed on the higher management classes resulting in a higher sensitivity level assigned (see Table 2.5.2-1 for results).

For example, the USFS "High" Scenic Integrity Objective (SIO) designation refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident. Similarly, the BLM Visual Resource Management (VRM) Class II objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Both of these agency visual management objectives would significantly restrict the construction of a high voltage transmission line because plan amendments would be necessary, and therefore are assigned a "High" sensitivity level. Class I VRM and Preservation VQO areas are typically associated with wilderness areas, and are assigned an Exclusion status. Conversely, VRM Class IV or Maximum Modification VQO's typically allow the highest level of viewshed modification, and are assigned a Low sensitivity due to the relatively low sensitivity of an area to viewshed change from an agency planning perspective.

National and state scenic and historic corridors, such as trails and highways were also considered in the visual resources inventory. These corridors were mapped for consideration in the transmission line siting analysis, and potential foreground views were determined.

Parks, recreation, and preservation areas other than scenic and historic trails and residential areas are covered in the land use sections of this document, as are Wild and Scenic Rivers.

Agency Visual Management Objectives

Two federal agencies have jurisdiction over public lands in the study area: the BLM and the USFS. These lands are administered by visual resource management objectives identified BLM Resource Management Plans (RMP's), Management Framework Plans (MFP's), and USFS Forest Plans.

The BLM utilizes Visual Resource Management (VRM) classes (as outlined in VRM Manual Section 8411) to regulate or guide the amount of change allowed on public lands managed by BLM. The BLM currently uses four VRM class management levels (refer to Table 2.4.2-1 below).

Similar to the BLM VRM Classes, the USFS assigns Visual Quality Objectives (VQO's) under the Visual Management System (VMS) for the visual management of USFS lands. Definitions of VQOs are shown in Table 2.4.2-2. All but the Sawtooth National Forest in the study area utilize VQOs for the management of visual resources.

Agency Visual Management data sets were obtained from the State of Idaho BLM Office, individual Montana BLM Field Offices, and each National Forest if available. Agencies typically provided VRM or

VQO data in the form of GIS shape files where available. VRM data was also copied from hard copy mylar maps available for viewing at the Upper Snake Field BLM Office (Big Lost MFP only).

Table 2.4.2-1 BLM Visual Resource Management (VRM) Classes

Class I	This class provides primarily for natural ecological changes; however, it does not preclude very limited activity. Any contrast created within the characteristic environment must not attract attention.
Class II	Changes in any of the basic elements (form, line, color and texture) caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not be evident or attract attention in the characteristic landscape.
Class III	Contrasts to the basic elements (form, line, color, texture) caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing characteristic landscape.
Class IV	Contrasts may attract attention and be a dominant feature in the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, texture) inherent in the characteristic landscape.

Source: BLM 1984a

Table 2.4.2-2 USFS Visual Quality Objectives (VQOs)

Preservation	Ecological changes only; applied to wilderness areas and certain other special designation areas.
Retention	Alterations must not be evident to the casual viewer.
Partial Retention	Alterations must remain visually subordinate to the characteristic landscape. New form, line, color or texture may be introduced as long as they remain visually subordinate.
Modification	Management activities may visually dominate characteristic landscape, but must reflect naturally established form, line, color and texture to be compatible with the surroundings.
Maximum Modification	Management activities may visually dominate, but must appear as natural occurrences at background distance (five miles or more). In the middleground and foreground, alterations may be out of scale and less compatible with the natural landscape.

Source: USDA 1974

Scenic Corridors

The trails and byways were identified within the study area, and were obtained from National Byways Online mapping (NSBO 2006), Montana and Idaho State Byways websites, and Montana and Idaho BLM and Forest Service data sources.

2.4.3 Cultural Resources

Given the size of the Study Area (25,000 square miles, including over 11,000 square miles in Idaho and nearly 14,000 square miles in Montana), it was not possible to compile archaeological and historic site records or cultural resource survey data for the two states. Thousands of cultural resources have been

previously recorded in southwestern Montana and eastern Idaho despite there having been only limited cultural resource survey in the region.

In Montana only 8 percent of Federal land and only 2 percent of non-Federal land has been surveyed for cultural resources (Wilmoth 2006), and in Idaho, less than 7 percent of land has been surveyed for cultural resources, almost all of it Federal (Reid 2006). Therefore, it is likely that the majority of cultural resources in both areas have never been identified or documented.

To obtain general information on cultural resources for the Siting Study, the following sources of data were used:

- Summary data provided by the Idaho State Historic Society (ISHS) in Boise and the Montana Historical Society (MHS) in Helena.
- Telephone and in-person interviews with ISHS (Davis 2006; King 2006; Neitzel 2006; Reid 2006) and MHS (Hampton 2006; Murdo 2006; Warhank 2006; Wilmoth 2006) staffs.
- Telephone and in-person interviews with Bureau of Land Management (BLM) (Cresswell 2006; Hill 2006; Kiely 2006; Lytle 2006; McDonald 2006, Sant 2006; Smith 2006), (U.S. Forest Service (USFS) (Beckes 2006; Ryan 2006), Department of Energy (DOE) (Pace 2006), and National Park Service (NPS) (Lyon 2006) cultural resource specialists.
- The National Register Information System (NRIS) of the National Register of Historic Places (National Register) (Byrne 2006).
- The National Historic Landmarks Survey of the NPS.
- Summaries of the prehistory and history of southwestern Montana and eastern Idaho.
- Selected cultural resource compliance documents, resource management plans, and technical reports.

There are major differences in the available cultural resource data from the two states. The MHS has a Cultural Resource Information System (CRIS) database in which data on all recorded cultural resources in Montana are provided. The ISHS is in the process of compiling a similar database for Idaho, but the data are not yet available for use. To obtain cultural resource summary data for Idaho that would be comparable to that from Montana would require manual inspection of thousands of archaeological and historic site inventory forms, and this was not completed for this study.

Cultural resources include districts, sites, buildings, structures, or objects important to a culture, subculture, or community for scientific, traditional, religious or other reasons. For this Siting Study Report, cultural resources have been divided into three major categories: archaeological resources, architectural resources, and known or potential sacred sites.

Archaeological resources are locations where human activity has measurably altered the earth or left deposits of physical remains (e.g., tipi rings, cairns, stone tools, petroglyphs, house foundations, trails, bottles, tin cans). Most archaeological resources in Idaho and Montana are Native American or Euro-American in origin.

Architectural resources includes standing buildings (e.g., houses, barns, outbuildings, mills, schools, churches) and intact structures (e.g., dams, canals, fence lines, roads, bridges, mine adits). Most architectural resources in the Study Area are Euro-American.

Sacred sites are resources considered to be of spiritual importance to Native Americans. Because of their sensitivity, few sacred sites have been publicly identified as such by Native American groups. However, data from the MHS suggests that in Montana certain classes of archaeological sites (e.g., pictographs and petroglyphs, Native American graves, vision quest sites, medicine wheels, eagle catching pits) are often considered sacred. Other archaeological features, such as tipi rings and rock cairns, are considered sacred by some Native American groups, but not by all (Murdo 2006).

Other classes of cultural resources, such as Traditional Cultural Properties (Parker and King 1998) and cultural landscapes (Birnbaum 1994), are not addressed in this analysis because they are relatively uncommon.

2.4.4 Biological Resources

Data and information on wildlife and vegetation resources within the study area was obtained from a variety of sources, including the U.S. Fish and Wildlife Service, BLM, Beaverhead-Deerlodge National Forest, Targhee National Forest, Gallatin National Forest, Craters of the Moon National Monument, Montana Natural Heritage Program, Montana Fish, Wildlife & Parks, Montana GAP, Idaho Conservation Data Center, Idaho Fish and Game, and Idaho GAP.

Biological data were also obtained from BLM Resource Management Plans and National Forest Land and Resource Management Plans, as well as through personal communication with agency wildlife biologists. Additional information was obtained from published literature and technical reports. All biological resource inventory data for the study area were mapped utilizing GIS.

For the purpose of this siting study, emphasis was placed on obtaining the locations of sensitive/unique communities and important habitats for special status species that occur within the study area. Special status species include those listed as threatened, endangered, proposed, or candidate under the Endangered Species Act (USFWS 2006, USFWS 2006*a*), those classified as sensitive by the BLM and USFS (BLM 2006, BLM 2004, USFS 2006), and those classified as species of special concern by the states of Montana and Idaho.

2.4.5 Water Resources and Wetlands

Water resources evaluated for this study include lakes, reservoirs, rivers, floodplains, and wetlands. Information on water resources within the study area was obtained from a variety of sources. Data lakes, reservoirs, rivers, and streams were compiled based upon information from the National Hydrology Dataset, Montana Water Center, Montana Natural Resource Information System, Environmental Protection Agency, and Idaho Department of Water Resources.

Floodplain data were obtained from the Federal Emergency Management Agency (FEMA). Wetlands were derived from the National Wetlands Inventory (NWI) and Idaho and Montana GAP data. FEMA and NWI data were only available for a limited portion of the study area.

2.4.6 Engineering Constraints and Geohazards

Geohazards and engineering constraints for the Townsend-Midpoint project were evaluated based on issues related to the siting and construction of a 500kV electric transmission line. Emphases were placed on the aspect of regional engineering constraints and slopes.

Data pertaining to landslides, karst, exposed bedrock and expansive soils was identified and mapped from a number of sources: USGS Natural Hazard Program, National Geophysical Data Center – Natural Hazards Data, Idaho Geological Survey, Montana Bureau of Mines and Geology, Idaho and Montana GAP data, and Natural Resources Conservation Service National Cartography and Geospatial Center (NCGC) State Soil Geographic (STATSGO) Database.

Digital elevation data was acquired from USGS National Elevation Data Set and used to evaluate slope constraints. Landslide, karst and expansive soils GIS data was included in the study, but the majority of this digital hazard data is at a scale, which is not considered detailed enough for conventional GIS analysis. It is sufficient to indicate general areas prone to natural geologic hazards.

2.5 SENSITIVITY ANALYSIS

The resource inventory data and associated maps were used as a basis for sensitivity analyses. Criteria were developed for each resource to help determine the sensitivity to the siting and construction of a transmission line. Further the sensitivity levels were intended to provide geographic opportunities and constraint parameters for locating potential alternative corridors. Sensitivity is defined as a measure of probable adverse response of a resource to direct and indirect impacts associated with the construction, operation and maintenance of a transmission line. The determination of sensitivity included consideration of the following:

- **Resource Value**: A measure of rarity, intrinsic worth, singularity, or diversity of a resource within a particular area.
- **Protective Status**: A measure of the formal concern as expressed by legal protection or special status designation.
- **Present and Future Uses**: A measure of the level of potential conflict with land management and land use policies.
- **Hazards**: A measure of the degree to which construction and operation of the transmission line could be affected by a known resource hazard.

Using this framework, the mapped inventory data were analyzed and assigned relative sensitivity values. Sensitivity maps were developed for land use, visual, cultural, biological, water and earth resources. Sensitivity levels were categorized as exclusion, high, moderate or low based upon the following characteristics:

- **Exclusion:** Areas where the siting of transmission lines is essentially precluded. This category includes:
    1) areas which contain polices for legally protected resources (e.g. wilderness area, national park);
    2) where government regulation expressly prohibits encroachment;
    3) where ownership and use of the land preempts the siting of a transmission line; and
    4) areas where there would be unacceptable hazards to the construction or operation of a transmission line.

- **High:** Includes areas which have the following characteristics:
    1) unique, highly valued or complex resource areas;
    2) significant potential conflict with a current or planned use;
    3) areas possessing substantial hazards to construction and operation of a transmission line;

4) resource areas or conflicts with identified hazards typically requiring long term and costly mitigation or high design and construction costs;

5) areas which could require lengthy, complex review, and permitting requirements with likelihood of approval uncertain or low;

6) areas which have a high level of concern for potential high impacts to a resource;

7) mitigation is not likely to be effective in substantially reducing significant impacts;

8) resource is considered to be of exceptional value in its present or undisturbed state; and

For the purpose of this study, areas designated as high sensitivity are considered to be the least desirable and should be avoided, if possible.

- **Moderate:** Includes areas which have the following characteristics:

  1) the presence of resources that are important, valued and/or assigned special status;

  2) resources with moderate (some) potential conflict with current or planned use;

  3) limited hazards to construction or operation of a transmission line;

  4) resource sensitivity is of concern but has a reasonable potential for mitigation to reduce high impact, depending on the severity of the impact; and

  5) resources in this sensitivity level may in some instances be proposed for a specific land management designation, but have not officially been designated.

  For the purpose of this study, areas designated as moderate sensitivity are not considered to be highly desirable, but may be used with careful consideration of design, structure placement and the minimization of adverse impacts.

- **Low:** Includes areas which have the following characteristics:

  1) areas which have not been classified as exclusion, high or moderate;

  2) areas where, if permits are required, they are routinely issued;

  3) areas with little or no conflict with existing or planned land uses;

  4) no cultural resources or no valued or special status biological or water resources; and

  5) no hazards to construction or operation of a transmission line.

  For the purpose of this study, areas designated as low sensitivity are most desirable for the siting of a transmission line. It should be noted, however, that additional site specific studies could reveal other sensitive resources not currently inventoried through the regional environmental study process.

Overlays of individual resource sensitivity maps were then created to aid in the development of a composite sensitivity map. The composite sensitivity map includes exclusion, high, moderate and low sensitivity levels, and provides a comprehensive representation of opportunities and constraints for the location of transmission corridors.

The following sections describe the sensitivity criteria used for each resource area.

2.5.1 Land Use

As part of the investigation, an analysis was conducted to identify land use resource sensitivity. Sensitivity is the measure of probable adverse response of each resource component to direct and indirect impacts associated with the construction, operation, maintenance and abandonment of the proposed transmission line. Criteria used in this determination can be found in Section 2.5. A map was developed to indicate the areas of exclusion, high, moderate, and low sensitivity identified for each resource component. This process helped to guide the development of alternative corridors. The specific sensitivities identified for land use resource components are listed in Table 2.5-1.

Residential development was identified using incorporated boundaries of cities and villages, and an analysis of parcel concentrations within PLSS sections conducted where data was available. Parcel data was available in all of Montana and in Blain County, Idaho. Using existing parcel data in areas outside of incorporated municipal boundaries, private land was analyzed for residential development potential. Within each section, parcel numbers were counted to determine average lot size. Ten acre average parcel size or less within the section was considered to have the highest potential for residential development, and was placed in the exclusion category. Sections with parcels sizes averaging 10 to 20 acres were considered high sensitivity, and sections with average parcel sizes of 20 to 40 acres were assigned a moderate sensitivity. Lands inside of incorporated municipal boundaries where assigned an exclusion status for routing purposes.

Table 2.5-1. Sensitivity Ratings for Land Use Resources

Resource Component	Exclusion	High	Moderate	Low	Rationale*
Military Facility (Limestone Hills Training Area-North of 500 kV Colestrip Transmission Line)	•				1,2
Airports (public and private)	•				1,6
Wilderness	•				11
Recommended Wilderness	•				11
Wilderness Study Area	•				11
BLM ACEC (Beaverhead Rock, Tee-Maze)	•				9, 10, 11
National Wildlife Refuge		•			1, 5, 9,10
National Monument and Preserve		•			1, 5, 9, 11
National Historic Site		•			1, 5, 9, 11
National Battlefield		•			1, 5, 9, 11
National Forest - Inventoried Roadless Area		•			1, 9, 11
National Natural Landmark		•			1, 5, 9, 11
Research Natural Area		•			1, 9, 10,11
BLM ACEC (refer to Table 3.1-5 and Table 3.1-10)		•			1, 9, 10, 11
State Park		•			1, 7, 8, 9, 10
State Wildlife Management Area		•			1, 10

Resource Component	Exclusion	High	Moderate	Low	Rationale*
Private Conservation Area		•			1, 9, 10
Urban/Developed Area		•			1, 5, 7, 8, 9
1,000 feet separation from existing EHV transmission line(s)		•			12
Idaho National Laboratory		•			1, 5
Agriculture/Pasture		•			3, 4
Military Training Route			•		2
South of 500 kV Colstrip Transmission Line in Limstone Hill Training Area (BLM Withdrawl)				•	1
Vacant/Undeveloped				•	-
Lands within incorporated boundaries	•				13
10 acre parcels average or greater per PLSS section	•				13
10 to 20 acre parcels average per PLSS section		•			13
20-40 acre parcel average per PLSS section			•		13

*Construction and operation of a transmission line could result in:
(1) Permanent preclusion of existing, permitted or planned land uses.
(2) Constraints to military testing and training operations that may occur at low altitudes (e.g., helicopter low-altitude tactical navigation areas, military operations areas, and military training routes). These structures may also be a source of ground-based and aircraft radar interference.
(3) Long-term conversion/loss of productive agricultural land.
(4) Interference with agricultural equipment, operations, irrigation practices, wind breaks, or aerial spraying activities that would result in long-term impairment of agricultural operations and productivity.
(5) Conflicts with Federal land use management plans, policies, goals, or regulations.
(6) Hazard and safety risks to aviation operations/activities.
(7) Conflicts with existing or proposed recreation uses and facilities.
(8) Permanent or long-term preclusion of a recreational use.
(9) Long-term disturbances that would diminish the quality of a particular land use.
(10) Promote increased public access. Increased access could lead to indirect impact such as increased hunting, (legal and illegal), vehicles being driven to create new roads, or dispersed clearing of vegetation and littering.
(11) Agency Management Action/Standard
(12) Transmission line technical compatibility/reliability issues
(13) Conflicts with residential areas

2.5.2 Visual Resources

This section describes the siting criteria used to identify project corridors for visual resources in the study area. For the purpose of this study, the agency visual management classes were used as primary siting criteria for the transmission line. Class I VRM and Preservation VQO designations are typically assigned in Wilderness Areas, Wilderness Study Areas, Areas of Critical Environmental Concern (ACEC), etc., and therefore would typically preclude transmission line siting. These are generally the most valued and rare landscapes. Table 2.5.2-1 summarizes the rationale for assigned sensitivity levels.

Table 2.5.2-1 Visual Resource Sensitivity Rating Table: Agency Management Objectives

	Agency Objectives		
Sensitivity Level	***FS Visual Quality Objective (VQO)***	***BLM Visual Resource Management Class (VRM)***	**Sensitivity Rationale**
Exclusion	Preservation	I	Rare, unique, pristine, very high quality landscapes, or landscapes protected by legislation or from most forms of development due to agency management policies for visual resources. Project construction in these areas will, under no circumstances, be compatible with current agency visual objectives, will require a plan amendment for project construction, and has a low probability of approval.
High	Retention	II	High Quality, somewhat rare landscapes precluded from many forms of development due to agency management policies for visual resources. Project construction in these areas will not be compatible with current agency visual objectives, will require a plan amendment for project construction, and has an uncertain probability of approval. Basic visual changes may be seen, but should not be evident. Visual influence of the project in these areas are expected to be moderately high to high.
Moderate	Partial Retention	III	Moderate quality, somewhat common landscapes not precluded from development, but where project may not conform to agency management policies for visual resources. Project construction in these areas may be compatible with current agency visual objectives, will not likely require a plan amendment for project construction, and has a moderate probability of approval. Changes may occur, but they must be subordinate to the overall landscape. Visual influence of the project in these areas are expected to be moderate to low.
Low	Modification and Maximum Modification	IV	Lowest quality, most common or most developed landscapes where development is allowed, directed, or routinely permitted; and where deviation from landscape character may be dominant.

High density parcel sections (residential), National Historic and Scenic trails, and Scenic (National and State) Highways and Byways were mapped with a 3/4-mile High Sensitivity buffer where foreground views of high sensitivity viewers of the project would be expected (Exhibit 3).

2.5.3 Cultural Resources

Cultural resources are protected by Federal and State laws if they are found to have some level of significance under the criteria of the National Register or under State guidance. Most of the cultural resources previously recorded in the Study Area have never been evaluated for National Register eligibility, but hundreds have been evaluated and can form the basis for a sensitivity analysis.

Under Section 106 of the National Historic Preservation Act (NHPA), an undertaking, such as construction of a transmission line on Federal land, results in adverse effects to a cultural resource listed in or eligible to the National Register when it alters the resource's characteristics, including relevant features of its environment or use, that qualify it for inclusion in the National Register. Potential impacts could include:

- Physical destruction, damage, or alteration of all or part of the property;
- Isolation of the property from, or alteration of the character of the property's setting when that character contributes to the property's qualification to the National Register;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
- Neglect of a property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of the property.

For this Siting Study, it is anticipated that potential effects of a transmission line on cultural resources would generally be related to either physical damage (e.g., ground disturbance at an archaeological site, demolition of a historic cabin) or changes in the visual setting (e.g., a transmission line disrupting the view of a historic ranch). Physical disturbance could potentially be an adverse effect for all three classes of cultural resources. A change in visual setting can potentially be a major adverse effect for National Register-listed or eligible architectural resources and for Native American sacred sites, but is usually not a consideration for most archaeological sites because their National Register eligibility is more often tied to scientific importance than to setting.

The approach used in the sensitivity analysis is based in part on a similar analysis performed for a transmission line in Wyoming and Montana by SWCA Environmental Consultants (Bolling and Seddon 2005). For the Townsend-to-Midpoint analysis, sensitivity criteria for cultural resources are defined as follows:

Exclusion areas are locations where the siting of transmission lines is essentially precluded. With reference to cultural resources, important components of this category are: 1) areas which contain policies for legally protected resources; 2) areas where government regulations expressly prohibit encroachment; 3) cultural resources of national significance; and 4) cultural resources or natural features of high spiritual value to Native Americans. For this analysis, exclusion areas include:

- Units of the National Park System with a prehistoric or historic theme. These include National Parks, National Monuments, National Historic Sites, National Historic Parks, National

Memorials, and National Battlefields. National Historic Trails (e.g., Oregon National Historic Trail) do not receive special consideration beyond their status as National Register properties unless they cross Federal land (Neitzel 2006).

- National Historic Landmarks (NHLs), which by definition are considered to have national historic significance. NHLs are also automatically listed in the National Register of Historic Places.
- Sacred sites specifically identified by Native Americans. Consultation with Native American groups to identify sacred sites was not conducted for this siting study.

Appropriate buffer zones should be established around these resources if it is determined that their visual settings could be adversely affected by a transmission line.

Also, some BLM Areas of Critical Environmental Concern (ACECs) were established to protect cultural resources. ACECs in the Study Area have been categorized as Exclusion Areas in the Land Use analysis (see Section 2.4.1).

High Sensitivity areas are unique, highly valued, or complex cultural resources. For High Sensitivity cultural resources, avoidance is the preferred management option; data recovery and other mitigation measures may not be effective in reducing adverse effects and could, in some cases, contribute to adverse effects. For this analysis, High Sensitivity areas include:

- Archaeological and architectural resources that are listed in the National Register of Historic Places.
- Potential sacred sites that have not been specifically identified as such by Native Americans. These resources were identified by the MHS (Murdo 2006). Consultation with Native American groups to identify sacred sites was not conducted as part of the analysis.

National Register-listed resources include individual properties as well as historic districts (e.g., urban neighborhoods, commercial districts, mining districts) that may contain multiple individual buildings and structures that are contributing elements to the district. Some National Register-properties may require buffer zones to reduce or avoid adverse effects, depending on the importance of visual setting to their National Register eligibility. However, many listed properties may not require buffer zones except to protect them from physical disturbance.

In oil and gas exploration and development projects in Montana, a 0.5-mile buffer is usually sufficient avoidance for the various classes of sacred sites (Sant 2006). A similar radius may be adequate for transmission lines and structures.

Moderate Sensitivity areas are cultural resources that are considered important, valued, or otherwise assigned a special status. For this analysis, Moderate Sensitivity areas include:

- Cultural resources that have been determined eligible to the National Register or that are in the process of review by the SHPO.

Low Sensitivity areas are those areas that have a low probability of containing significant cultural resources. Low sensitivity areas include:

- Cultural resources that have been determined ineligible to the National Register.

- Areas that have been systematically and intensively surveyed by archaeologists and that are known to contain no National Register-eligible cultural resources.

- Areas that are considered to have a low probability of containing undisturbed cultural resources because of natural conditions (e.g., very steep slopes, lack of natural water sources) or past disturbance (e.g., erosion, recent urban or industrial development, extensive modern agriculture).

Data for defining Low Sensitivity areas were not compiled for this analysis, but it is anticipated that relatively little of the Study Area would fall into the Low Sensitivity category for cultural resources.

No Data. It is estimated that only 8 percent of Federal land in the state of Montana has been surveyed for cultural resources and that only 2 percent of non-Federal land in that state has been surveyed (Wilmoth 2006). In Idaho, less than 7 percent of land has been surveyed for cultural resources, almost all of it Federal (Reid 2006). Therefore, most land within the Study Area has not been intensively and systematically surveyed by professional archaeologists according to modern standards. For this reason, most land in the Study Area can not be assigned to either Low Sensitivity, Moderate Sensitivity, High Sensitivity, or Exclusion.

2.5.4 Biological Resources

Sensitivity ratings were assigned to a number of biological resources within the study area. These ratings were based upon a relative evaluation of the resource's legal status and the impact potential that a transmission line and associate infrastructure would have upon that resource. The only resources designated as exclusion in the study area were bald eagle nests, since the bald eagle is a federally listed species and there are specific federal restrictions on transmission line construction in proximity to a bald eagle nest.

Federally listed plant species and habitats for other federally listed wildlife species that occur in the study area, including bull trout critical habitat and yellow-billed cuckoo nesting habitat, were designated as high sensitivity because these areas should be avoided but could be spanned/avoided by a transmission line. Important habitats for BLM and USFS sensitive wildlife species, including leks, bat hibernacula, and nesting sites for colonial waterbirds, trumpeter swans, raptors, and falcons, were also classified as high sensitivity because a transmission line could adversely affect these species/habitats. Designated waterfowl production areas were also designated as high sensitivity because of the collision hazard potential.

BLM and USFS sensitive plant species and riparian habitats are designated as moderate sensitivity. Important wildlife habitats, including greater sage-grouse key habitat, mountain plover breeding habitat, Raptor Management Areas, and critical elk and bighorn sheep winter ranges are also classified as moderate sensitivity. While these are considered important habitats and receive special attention and management status by the states and land management agencies, they do not possess any special legal protection and transmission lines could be designed to minimize potential adverse impacts to these resources.

The Greater Yellowstone Ecosystem (GYE) does not have any legal protection, management policies, goals or objectives, or even agreed upon boundaries. It is, however, a recognized unique area in terms of ecological processes, the potential occurrence of rare, threatened, and endangered species, and abundance of intact habitats that supports indigenous plant and animal species. Historic predator-prey interactions that take place remain largely unchanged as compared to pre-European settlement. The presence of these important and valued resources and the recognized establishment of the GYE as a special ecosystem that is one of the last remaining largely intact provides a basis for a moderate sensitivity assignment. The

boundaries are based on a conservative overall area (19 million acres) as identified by Clark and Minta in a 1994 study (USDI 2006).

All other areas were classified as low sensitivity for biological resources. Table 2.5.4-1 summarizes the sensitivity designations and rationale for each of the biological resource components that were mapped for this study.

Table 2.5.4-1 Sensitivity Ratings for Biological Resources

Resource Component	Sensitivity				Rationale
	Exclusion	High	Moderate	Low	
Federal Threatened and Endangered plant species		•			Federally listed species have statutory protection pursuant to the Endangered Species Act.
BLM and USFS Sensitive plant species			•		BLM and USFS management plans provide for protection of sensitive species and their habitats.
Riparian habitats			•		Riparian habitats support a number of federally listed and BLM/USFS sensitive species (i.e., bald eagle nests and roosts)
Bald eagle nests and winter roosts (w/ ½ mile buffer)	•				Federally-listed species. Montana Bald Eagle Management Plan and BLM prohibit construction of transmission lines within ½ mile of nests.
Bull trout critical habitat		•			Designated critical habitat for a federally-listed species. Transmission lines can be designed to span the stream/river.
Yellow-billed cuckoo nests (w/ ½ mile buffer)		•			Nesting habitat for a federally-listed species.
Greater sage-grouse leks (w/ ½ mile buffer)		•			BLM, USFS, and state sensitive species. Some BLM districts prohibit development within ½ mile of active leks. State management plans discourage transmission lines in proximity to leks. Conservation Assessment promotes 2 mile buffer.
Greater sage-grouse key source habitat			•		BLM, USFS, and state management plans discourage construction of new transmission lines through key source habitat.
Sharp-tailed grouse leks (w/ ½ mile buffer)		•			BLM and state sensitive species. Some BLM districts prohibit surface development within ½ mile of active leks.
Trumpeter swan breeding habitat		•			BLM and USFS sensitive species. Montana Species of Concern. Red Rocks Lake NWR created for swan protection.
Colonial bird breeding habitat		•			Areas support breeding colonies of several bird species listed as sensitive by the BLM and the states.

Resource Component	Sensitivity				Rationale
	Exclusion	High	Moderate	Low	
Federal Threatened and Endangered plant species		•			Federally listed species have statutory protection pursuant to the Endangered Species Act.
BLM and USFS Sensitive plant species			•		BLM and USFS management plans provide for protection of sensitive species and their habitats.
Waterfowl Production Area		•			Designated by the Dillon BLM as a sensitive habitat with restrictions on projects that would affect waterfowl. Area supports numerous sensitive bird species.
Great blue heron rookery (w/ ½ mile buffer)		•			State protected species and sensitive habitat. Fledglings vulnerable to collision with transmission lines in proximity to rookery.
Raptor and falcon nests w/ ½ mile buffer– northern goshawk, ferruginous hawk, peregrine falcon, merlin, and great gray owl.		•			BLM and USFS sensitive species and state species of concern. BLM and USFS have restrictions on development in proximity to nests and within breeding territories.
Bat roosts and hibernacula		•			BLM and USFS sensitive species and state species of concern. Roosts and hibernacula considered sensitive habitats.
Mountain plover breeding habitat			•		BLM and USFS sensitive species and state species of concern.
Raptor Management Area			•		Area supports high density of ferruginous hawk nests. Designated by the Dillon BLM as a sensitive habitat and prohibits surface occupancy within ½ mile of a nest.
Crucial/critical elk and bighorn sheep winter range			•		Designated as sensitive habitats by BLM, USFS, and states. State and USFS guidelines seek to minimize construction of new roads/increase road densities in these areas.
Greater Yellowstone Ecosystem			•		One of the last contiguous areas where large-scale landscape processes such as large native mammal migration, fire cycles, and predator-prey interactions take place and remain largely intact.

2.5.5 Water Resources and Wetlands

Sensitivity criteria were developed to reflect the sensitivity of water resources relative to the identification of transmission line corridors. The primary objective during the corridor selection phase is to minimize the number of stream, river, and lake crossings, identify significant floodplains, and exclude portions of lakes, reservoirs, or rivers that exceed allowable span widths. Federal, state, and local regulations regarding water resources would be addressed during the project design phase.

Floodplains represent a potential hazard for transmission line siting. While there are no legal statutes prohibiting the placement of transmission line structures in regulated floodplains, construction in these areas could create severe engineering constraints and result in significant adverse environmental effects. Specific flood elevations and migration of stream channels would also be assessed during transmission line permitting and design.

Freshwater wetlands are protected from fill/disturbance pursuant to Section 404 of the Clean Water Act. Wetlands also provide important habitat for a variety of special status plant and wildlife species, and could represent engineering constraints. However, wetlands would be assessed during transmission line permitting and design. Typically, these areas can be either spanned or avoided.

Table 2.5.5-1 identifies the sensitivity designations for each of the water resource components that are evaluated in this study. This table also summarizes the rationale for the designation.

Table 2.5.5-1 Sensitivity Ratings for Water Resources and Wetlands

Resource Component	Sensitivity				Rationale
	Exclusion	High	Moderate	Low	
Lakes/Reservoirs/Rivers			•		Waterbodies that exceed potential transmission line span lengths.
100-Year Floodplains			•		Potential for engineering constraints and adverse effects; can typically span.
Wetlands			•		Legally protected and potential for engineering constraints; can typically span.

2.5.6 Engineering Constraints and Geohazards

Earth resources sensitivities were based on natural geologic hazards: A measure of the degree to which construction and operation of the transmission line could be affected by a known resource hazard. Much of the available hazard information is very coarse regional scale and only provides generalized hazard locations.

Slope Gradient, Geology, Hydrology, Soil Overburden, Land-use, and Landform are all major factors associated with slope instability. Landslides and mass wasting events occur on slopes with gradients less than 25 degrees, but an increased incidence of failure occurs on slopes greater than 25 degrees. The majority of slopes in this category are in the northeast part of the project area, within the Rocky Mountains Province and small parts of the Basin and Range Province, which extend north of the Snake River Plain (Landslide Overview Map of the Conterminous United States, 1982).

Slope categories were established in relation to construction engineering issues and assigned sensitivity ratings based on the level of difficulty for road construction and site access. Slopes of 0-12% require little specialized engineering and were rated a low sensitivity. Slopes of 12% to 20% require more specialized engineering and were rated a moderate sensitivity. Slopes of >20% require more specialized engineering and could cause long term problems; they are given a high sensitivity rating.

There are areas of surficial bedrock outcropping in the form of basaltic volcanic flows of geologically recent activity. These are area where foundation construction, road construction and other activities would be more difficult and expensive. For this reason, these areas are given a moderate sensitivity rating.

Expansive soils are soils which have a high shrink/swell coefficient. These soils swell in volume by absorbing large amounts of water. Most expansive soils contain high amounts of the clay mineral montmorillonite. The majority of the expansive soils within the project area are in the northeast (Occurrence and Distribution survey of expansive materials in the United States, 1976). They are derived from rock types associated with the Rocky Mountain Province. Expansive soils can cause significant damage to road beds and structures. County level detailed soils data for this part of Idaho is incomplete, though regional STATSGO soils data includes expansive soils. These issues can be mitigated through onsite geotechnical evaluation and increased engineering design, a therefore they are given a moderate sensitivity rating.

The Madison Limestone in Montana, is a karst limestone deposit containing numerous caves and solution channels. Pseudokarst is a term used to describe the interconnected nature of lava tube cave systems and joint fractures in volcanic flows. Pseudokarst is similar to karst, in that the flows often contain cave systems and interconnected fractures. The presence of these cavities and fractures can create stability issues for road construction and transmission structure design.

Road construction in karst and pseudokarst terrain may also lead to groundwater contamination due to the interconnected nature of the solution cavities. Construction planning would likely require onsite geotechnical evaluation and more rigorous engineering design (Engineering Aspects of Karst, 1984). Digital mapping of pseudokarst in the Snake River plain would falsely indicate the entire area to have a moderate sensitivity. This would be the wrong assumption. There has not been sufficient detailed mapping completed in the area to indicate where construction issues may occur due to pseudokarst.

Table 2.5.6-1 identifies the earth resource sensitivities and defines the rational for there designation.

Table 2.5.6-1 Sensitivity Ratings for Engineering Constraints, Geohazards and Slope

Resource Component	Sensitivity				Rationale
	Exclusion	High	Moderate	Low	
Slopes greater than 25 degrees (Landslides)		•			Most major landslide events occur on slopes greater than 25 degrees.
Slopes from 0 to 12%				•	Require minimal engineering design issues.
Slopes from 12% to 20%			•		Require moderate engineering design issues.
Slopes greater than 20%		•			Require significant engineering design issues.
Bedrock outcrops (Basalt)			•		Require moderate engineering design issues, expensive construction.
Expansive Soils			•		Require moderate engineering design issues, expensive construction.

2.6 OPPORTUNITIES AND CONSTRAINTS

In order to identify potential locations for project facilities, information gathered during the data inventory was used to determine corridor and routing constraints and opportunities within the study area. The approach used to identify these opportunities and constraints are presented below.

For the purposes of this study, environmental constraints and opportunities were defined based on a sensitivity analysis for each environmental resource as previously described. Sensitivity was defined as a measure of the probable adverse response of each resource to direct and indirect impacts associated with the construction, operation, maintenance, and abandonment of the transmission line.

Tables were developed that assigned levels of sensitivity and constraint specific to different resource features. These tables, in turn, provided the guidelines necessary to assign classifications to the inventoried information. Once assigned, Geographic Information System (GIS) was utilized to reclassify information and map sensitivity and constraint levels for each of the environmental resources inventoried within the segments. Results from specific resource sensitivity and constraint analyses, including descriptions and tables may be found in Chapter 3. Maps depicting resource sensitivities are found as supplemental Exhibits. Having identified individual resource constraints, a summary of sensitivity constraints was made for environmental resources, and the GIS was used to create a composite environmental constraints map (see Exhibit 8). This map served to identify potential overall levels of environmental constraint for the location of project facilities.

Environmental constraints and opportunities were determined based on information gleaned from inventoried data including agency management plans and through internal review and discussions with the project team. The review of this information and results from these discussions were used to initially identify specific issues associated with the study area and later to characterize the constraints or opportunities associated with potential alternatives.

For the purposes of the Townsend to Midpoint 500 kV Transmission Line Project, siting opportunities and areas of low sensitivity were generally in areas of existing or planned linear facilities including corridors that have been previously disturbed or have been designated for future use as utility corridors. Typically, these opportunity areas were located near existing transmission lines (69kV and larger), major transportation corridors (interstate and state highways), pipeline corridors, and railroads. These opportunities were mapped on the Composite Sensitivity and Constraints Map (Exhibit 8) through all sensitivities except exclusion areas.

It is important to note that at this level of regional corridor study and further refinement of corridors may result in utilizing other elements such as sub-transmission lines, secondary roads, section lines, etc.

2.7 CORRIDOR AND SUBSTATION SITES

Having inventoried resources and defined sensitivities within the study area, potential transmission line corridors and substation sites were identified (See Exhibits 9 and 10).

As a first step towards identifying corridors, potential alternatives were reviewed based upon their ability to maximize the use of areas of opportunity while avoiding areas of higher environmental constraint. In this regard, each of the potential alternative transmission line corridors were characterized according to their level of environmental constraint (Low, Moderate, High, and Exclusion) as illustrated on Exhibit 10.

Corridors were identified on an overlay of the composite environmental sensitivity map. Areas of opportunity were identified based on the composite sensitivity, with priority given to geographical areas that provided highest opportunity (lowest constraint) in corridors between existing and proposed substations on the north and south ends of the project for each system alternative.

Two geographical areas were identified for potential substation siting based on system requirements, construction and operation costs, and environmental criteria (See Exhibit 9). These areas are identified as the Townsend Substation Area and the Ringling Substation Area. The primary factors in identifying potential substation sites included:

- Fifty acres minimum of vacant land;
- Suitable topography for construction to minimize cut and fill areas and overall disturbance. Maximum slopes of 8%;
- Existing roads within 1 mile;
- Ownership, land acquisition and public fees;
- Permitted uses, existing zoning, and permitting requirements;
- Close to existing Colstrip 500 kV transmission line: within 1 mile;
- Land acquisition costs based on Montana State Assessors; and
- Environmental issues identified during data collection and sensitivity analysis for the transmission line corridors (Composite Sensitivity Overlay).

2.8 ALTERNATIVE ROUTE IDENTIFICATION

After corridors were identified based on composite constraints, preliminary transmission line links and routes were developed. Existing aerial photography was used in conjunction with the composite constraints overlay to identify optimal location of assumed centerlines. During the routing processes, location of residential areas, stream crossings and agricultural fields was carefully considered.

2.9 ALTERNATIVE ROUTE RECONNAISANCE

Refinement of the routing options based on conditions not evident in aerial photography of from other data occurred based on field observations. Most of the preliminary routes were driven to the extent practical and areas of routing concerns and on the ground conditions were noted. Changes in conditions occurring from the time of the original aerial photography was taken influenced the final routing alignments. The final alignments evaluated during the preliminary impact assessment and alternatives comparison phases of the project were sited to reflect the most reasonable alignments for transmission line routing.

2.10 PRELIMINARY IMPACT ASSESSEMENT

Preliminary and residual impact levels for each of the alternatives were quantified based on crossing of resource sensitivity. Links, routes and subroutes were identified, and mileage of expected initial high, moderate and low impacts quantified. Preliminary expected initial impacts were correlated with resource sensitivity levels as follows:

- High Sensitivity=High Impacts
- Moderate Sensitivity=Moderate Impacts
- Low Sensitivity/Opportunity Areas=Low Impacts

Impact levels were modified for visual, cultural, and biological resources to one level below initial levels, except where Exclusion areas were crossed, to determine preliminary residual impact levels as follows:

1. If the route was within 200-feet of an existing roadway, the impact level was reduced for Biological and Cultural Resources.
2. If the route parallels an existing similar scale transmission line (230 kV or greater), potential visual impacts were reduced by one level.

The preliminary residual impact levels were used to compare the alternatives and determine which alternative was environmentally preferred. Mitigation measures were not used in the preliminary impact assessment. Potential mitigation measures developed for the project are shown in Appendix A-3.

2.11 ALTERNATIVES COMPARISION

Miles of impacts were quantified for the each of the subroutes and alternatives identified. The Preferred Route was selected based on environmental impact, engineering factors and total cost. Stream crossings, existing high voltage transmission line crossings, distance of existing high voltage transmission line ROW paralleling, total cost, and residual impact levels. Other factors, such as amount of public and private lands crossed were also considered. Substation sites were compared based on proximity to existing residences, composite sensitivity, access, location relative to the existing Colstrip 550 kV transmission line, permitting requirements (subdivision), and land cost.

2.12 PREFERRED ROUTE AND SUBSTATION SELECTION

The Preferred Route was selected based on the balance of expected environmental impact, overall costs, and engineering constraints. The preferred substation was identified based on the location, environmental constraints, need for road building and site grading, proximity to occupied residences, acquisition and permitting costs, parcel size, and proximity to the existing 500 kV Colstrip transmission line.